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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/750,128

12/29/2000

Dong Kyu Kim

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12/29/2004

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EXAMINER

TON, ANTHONY T

ART UNIT

PAPER NUMBER

2661

DATE MAILED: 12/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/750,128

Applicant(s)

KIM, DONG KYU

Examiner

Anthony T Ton

Art Unit

2661

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 July 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 18 and 36-39 is/are allowed.
- 6) ☒ Claim(s) 1,2,7-9,12-17,19,21,28,29,31-35 and 40 is/are rejected.
- 7) ☐ Claim(s) 3-6,10,11,20,22-27 and 30 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 June 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-946)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 7/19/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.



PHIRIN SAM
PRIMARY EXAMINER



Drawing Objection

1. The drawing is objected to because of the following informalities:

New corrected drawings are required in this application because **hand drawing** for **Figures 2, 3, 7a, 7b, 9 and 10** is informal. Applicant is advised to employ the services of a competent patent draftsman outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

Specification Objection

2. The disclosure is objected to because of the following informalities:

Term “**a** example” in page 11 line 17 is improper.

Examiner suggests changing this term to “**an** example”.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 1, 2, 7-9, 12, 14, 15, 21, 28, 29, 32, 33 and 40** are rejected under 35 U.S.C. 103(a) as being unpatentable over *the Admitted Prior Art* in **Fig.11**, in view of *Tal et al.* (US Patent No. **6,400,782**) hereinafter referred to as *Tal*.

a) **In Regarding to Claim 1:** *the Admitted Prior Art* disclosed a system for estimating frequency offset in an orthogonal frequency-division multiplexing (OFDM) system, comprising:

a sliding window correlation summing device that receives an input symbol (*see Fig.11: the combination of blocks 53 and 55*) and generates a sliding window correlation sum in accordance with a reference symbol (*see Fig.11: block 57*); and

a frequency offset estimator that is coupled to said sliding window correlation summing device and receives and processes said sliding window correlation sum to calculate a frequency offset estimation (*see Fig.11: the combination of blocks 59 and 61*).

The Admitted Prior Art failed to explicitly disclose a reference symbol comprises an analytic tone located in only one subchannel of said reference symbol.

Tal explicitly disclosed such a reference symbol comprises an analytic tone located in only one subchannel of said reference symbol (*see col.9 line 33 – col.10 line 28; and Fig.10: channel #1 and block 230*)).

At the time of the invention, it would be obvious to a person of ordinary skill in the art to combine such a reference symbol comprises an analytic tone located in only one subchannel of said reference symbol, as taught by *Tal* with *the Admitted Prior Art* for a purpose of frequency offset calculation in an OFDM system. The motivation for doing so would have been to be more efficient in terms of the number of complex multiplications performed per output sample (*see Tal: col.10 lines 43-49*). Therefore, it would have been obvious to combine *Tal* with *the Admitted Prior Art* in the invention as specified in the claim.

b) **In Regarding to Claim 2:** *the Admitted Prior Art* further disclosed the system further comprising a timing offset estimator that receives said input (*see Fig.11: block 63*) and generates said timing offset estimation independent of said frequency offset estimation (*see Fig.11: a switch used to isolate the output of timing offset and the output of frequency offset*).

c) **In Regarding to Claim 7:** *the Admitted Prior Art* further disclosed said sliding window correlation sum comprising:

a first delayer that delays said input signal in accordance with a frequency offset estimation interval to generate a first delayed output (*see Fig.11: block 53*);

a conjugator that performs a first operation on said first delayed output to generate a conjugated output (*see Fig.11: block 55*); and

a mixer that mixes said conjugated output and said input signal to generate a mixer output (*see Fig.11: block 57*).

d) **In Regarding to Claim 8:** *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claims 1 and 7.

The Admitted Prior Art failed to explicitly disclose (N-a2) samples are generated in a moving sum in accordance with said mixer output, and N represents a total number of subcarriers and a2 represents a frequency offset estimation interval.

However, *the Admitted Prior Art* in Fig.11 explicitly showed a moving sum (*see Fig.11: block 59*) having N/2 samples. The only difference between the instant claim and *the Admitted Prior Art* is N/2 compared to N-a2.

Therefore, at the time of the invention, it would be obvious to a person of ordinary skill in the art to implement such a moving sum to the moving sum to *the Admitted Prior Art* since

" $N/2$ " can be equal to " $N-a_2$ " if " a_2 " is equal to " $N/2$ ", thus such a moving sum is obvious in a design choice to a person of ordinary skill in the art, the motivation being to provide synchronization to communications between a base station and communications devices in an orthogonal division multiplexing system.

e) In Regarding to Claim 9: *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claim 1.

The Admitted Prior Art failed to explicitly disclose said frequency offset estimator comprising an analytic-tone phase compensation device that receives said sliding window sum and perform a phase compensation operation on said sliding window correlation sum to generate a phase-compensated output.

Tal explicitly disclosed such a frequency offset estimator comprising an analytic-tone phase compensation device that receives said sliding window sum and perform a phase compensation operation on said sliding window correlation sum to generate a phase-compensated output (*see Fig.10: block 240*)

At the time of the invention, it would be obvious to a person of ordinary skill in the art to combine such a frequency offset estimator comprising an analytic-tone phase compensation device that receives said sliding window sum and perform a phase compensation operation on said sliding window correlation sum to generate a phase-compensated output, as taught by *Tal* with *the Admitted Prior Art*, so that correct frequency offset estimation can be achieved in OFDM systems. The motivation for doing so would have been to maximize synchronization between a base station and communications devices in an OFDM system. Therefore, it would

have been obvious to combine *Tal* with *the Admitted Prior Art* in the invention as specified in the claim.

f) **In Regarding to Claim 12:** *the Admitted Prior Art* further disclosed the system further comprising a switch that outputs said frequency offset estimation in accordance with said timing offset estimation (*see Fig.11: the switch at the output of block 61 and a control line connected from Timing offset to such a switch*).

g) **In Regarding to Claim 14:** *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claim 1.

The Admitted Prior Art failed to explicitly disclose said analytic tone has at least one of a uniform magnitude and a uniform phase rotation and no coarse synchronization is required.

Tal explicitly disclosed such an analytic tone has at least one of a uniform magnitude and a uniform phase rotation and no coarse synchronization is required (*see col.6 lines 18-28 and lines 38-52: The complex output signal of the real to analytic transform 59 is multiplied by an adaptive phase rotation correction factor, generated by the PLL 61, via multiplexer 62*).

At the time of the invention, it would be obvious to a person of ordinary skill in the art to combine such an analytic tone has at least one of a uniform magnitude and a uniform phase rotation and no coarse synchronization is required, as taught by *Tal* with *the Admitted Prior Art* for a purpose of synchronization in an OFDM system. The motivation for doing so would have been to overcome problems of far end echo canceller (*see Tal: col.6 lines 31-36*). Therefore, it would have been obvious to combine *Tal* with *the Admitted Prior Art* in the invention as specified in the claim.

h) **In Regarding to Claim 15:** *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claim 1.

The Admitted Prior Art failed to explicitly disclose said frequency offset estimation is less than or equal to $(N/2a)$, where N represents a number of subcarriers and represents a number of samples.

However, *the Admitted Prior Art* in Fig.11 explicitly showed a moving sum (see Fig.11: block 59) having $N/2$ samples. The only difference between the instant claim and *the Admitted Prior Art* is $N/2$ compared to $N/2a$.

Therefore, at the time of the invention, it would be obvious to a person of ordinary skill in the art to implement such frequency offset estimation is less than or equal to $(N/2a)$, where N represents a number of subcarriers and represents a number of samples to *the Admitted Prior Art* since " $N/2$ " can be less than or equal to " $N/2a$ " if $a \leq 1$, thus such a moving sum is obvious in a design choice to a person of ordinary skill in the art, the motivation being to provide synchronization to a base station and communications devices in an orthogonal division multiplexing system.

i) **In Regarding to Claims 21, 28 and 32:** these claims are rejected for the same reasons as claims 1, 9 and 14, respectively because the apparatus in the system of claims 1, 9 and 14 can be used to practice the method steps of claims 21, 28 and 32.

j) **In Regarding to Claim 29:** *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claim 21.

The Admitted Prior Art failed to explicitly disclose a step of performing an operation to generate a calculated output.

Tal explicitly disclosed such a step of performing an operation to generate a calculated output (see col.19 line 63-col.20 line 12: perform a matched filtering operation. The correlator is adapted to generate an output every sample time).

At the time of the invention, it would be obvious to a person of ordinary skill in the art to combine such a step of performing an operation to generate a calculated output, as taught by *Tal* with *the Admitted Prior Art*, so that correct frequency offset estimation can be achieved in OFDM systems. The motivation for doing so would have been to maximize synchronization between a base station and communications devices in an OFDM system. Therefore, it would have been obvious to combine *Tal* with *the Admitted Prior Art* in the invention as specified in the claim.

k) **In Regarding to Claim 33:** *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claim 21.

The Admitted Prior Art failed to explicitly disclose (N-a2) samples are generated in a moving sum in accordance with said mixer output, and N represents a total number of subcarriers and a2 represents a frequency offset estimation interval.

However, *the Admitted Prior Art* in Fig.11 explicitly showed a moving sum (see Fig.11: block 59) having N/2 samples. The only difference between the instant claim and *the Admitted Prior Art* is N/2 compared to N-a2.

Therefore, at the time of the invention, it would be obvious to a person of ordinary skill in the art to implement such a moving sum to the moving sum to *the Admitted Prior Art* since “N/2” can be equal to “N-a2” if “a2” is equal to “N/2”, thus such a moving sum is obvious in a design choice to a person of ordinary skill in the art, the motivation being to provide

synchronization to communications between a base station and communications devices in an orthogonal division multiplexing system.

l) In Regarding to Claim 40: all claimed subject matter of this claim are the same as that of claim 21, **except for** said analytic tone has at least one of uniform magnitude and a uniform phase rotation.

Tal explicitly disclosed such an analytic tone has at least one of a uniform magnitude and a uniform phase rotation (*see col.6 lines 18-28 and lines 38-52: The complex output signal of the real to analytic transform 59 is multiplied by an adaptive phase rotation correction factor, generated by the PLL 61, via multiplexer 62*).

At the time of the invention, it would be obvious to a person of ordinary skill in the art to combine such an analytic tone has at least one of a uniform magnitude and a uniform phase rotation, as taught by *Tal* with *the Admitted Prior Art* for a purpose of synchronization in an OFDM system. The motivation for doing so would have been to overcome problems of far end echo canceller (*see Tal: col.6 lines 31-36*). Therefore, it would have been obvious to combine *Tal* with *the Admitted Prior Art* in the invention as specified in the claim.

5. **Claims 13, 16, 17, 19, 31, 34 and 35** are rejected under 35 U.S.C. 103(a) as being unpatentable over *the Admitted Prior Art* in **Fig.11**, in view of *Tal et al.* (US Patent No. **6,400,782**) as applied to claims 1, 2, 7-9, 12, 14, 15, 21, 28, 29, 32, 33 and 40 above, and further in view of *Raphaeli et al.* (US Patent No. **6,614,864**) hereinafter referred to as *Raphaeli*.

a) In Regarding to Claim 13: *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claim 1.

The Admitted Prior Art failed to explicitly disclose an estimation range of said system could be extended by adjusting a correlation interval between samples.

Raphaeli explicitly disclosed such an estimation range of said system can be extended by adjusting a correlation interval between samples (*see Fig.6: Correlators #1 & #2 in corresponding to β and α , respectively, hence an estimation range can be extended from β to α*).

At the time of the invention, it would be obvious to a person of ordinary skill in the art to combine such an estimation range of said system can be extended by adjusting a correlation interval between samples, as taught by *Raphaeli* with *the Admitted Prior Art*, so that synchronization can be achieved when a receive signal is accurately timed in both timing estimation and frequency estimation. The motivation for doing so would have been to provide a weighted average that yields more stability since the average of all the symbols in a template are used (*see Raphaeli: col.18 line 67 – col.19 line 2*). Therefore, it would have been obvious to combine *Raphaeli* with *the Admitted Prior Art* in the invention as specified in the claim.

b) In Regarding to Claim 16: *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claims 1 and 15.

The Admitted Prior Art failed to explicitly disclose a maximum estimation range of the estimation is determined in accordance with said number of samples.

Raphaeli explicitly disclosed such a maximum estimation range of the estimation is determined in accordance with said number of samples (*see col.18 lines 65-67: a specified range*).

At the time of the invention, it would be obvious to a person of ordinary skill in the art to combine such a maximum estimation range of the estimation is determined in accordance with said number of samples, as taught by *Raphaeli* with *the Admitted Prior Art*, so that synchronization can be achieved when a receive signal is accurately timed in both timing estimation and frequency estimation. The motivation for doing so would have been to provide a weighted average that yields more stability since the average of all the symbols in a template are used (*see Raphaeli: col.18 line 67 – col.19 line 2*). Therefore, it would have been obvious to combine *Raphaeli* with *the Admitted Prior Art* in the invention as specified in the claim.

c) **In Regarding to Claim 17:** *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claims 1, 15 and 16.

The Admitted Prior Art failed to explicitly disclose said maximum estimation range is ± 32 subcarrier spacing when N has a value equal to 1.

Raphaeli explicitly disclosed such a maximum estimation range is ± 32 subcarrier spacing when N has a value equal to 1 (*see col.18 lines 65-67: a specified range*).

Therefore, at the time of the invention, it would be obvious to a person of ordinary skill in the art to implement such an estimation to the *Raphaeli* since the “ ± 32 ” is a quantity of a “64” subcarrier spacing when N has a value equal to 1, thus such an estimation is obvious in a design choice to a person of ordinary skill in the art, the motivation being to provide synchronization to a base station and communications devices in an orthogonal division multiplexing system.

d) **In Regarding to Claim 19:** all claimed subject matter of this claim are the same as that of claim 1, except for an analytic tone is used in a correlation function.

Raphaeli explicitly disclosed such an analytic tone is used in a correlation function (see col.19 line 63-col.20 line 3: *The correlator functions to correlate a matched filtering operation*).

At the time of the invention, it would be obvious to a person of ordinary skill in the art to combine such an analytic tone is used in a correlation function, as taught by *Raphaeli* with *the Admitted Prior Art*, so that synchronization can be achieved when a receive signal is accurately timed in both timing estimation and frequency estimation. The motivation for doing so would have been to determine the maximum value output of the correlator over a period of time (see *Raphaeli*: col.20 lines 1-2). Therefore, it would have been obvious to combine *Raphaeli* with *the Admitted Prior Art* in the invention as specified in the claim.

e) **In Regarding to Claim 31:** this claim is rejected for the same reasons as claim 13 because the apparatus in the system of claim 13 can be used to practice the method steps of claim 31.

f) **In Regarding to Claim 34:** *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claim 21.

The Admitted Prior Art failed to explicitly disclose a maximum estimation range of the estimation is determined in accordance with said number of samples.

Raphaeli explicitly disclosed such a maximum estimation range of the estimation is determined in accordance with said number of samples (see col.18 lines 65-67: *a specified range*).

At the time of the invention, it would be obvious to a person of ordinary skill in the art to combine such a maximum estimation range of the estimation is determined in accordance with

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said number of samples, as taught by *Raphaeli* with *the Admitted Prior Art*, so that synchronization can be achieved when a receive signal is accurately timed in both timing estimation and frequency estimation. The motivation for doing so would have been to provide a weighted average that yields more stability since the average of all the symbols in a template are used (*see Raphaeli: col.18 line 67 – col.19 line 2*). Therefore, it would have been obvious to combine *Raphaeli* with *the Admitted Prior Art* in the invention as specified in the claim.

g) In Regarding to Claim 35: *the Admitted Prior Art* disclosed all aspects of this claim as set forth in claims 21 and 34.

The Admitted Prior Art failed to explicitly disclose said maximum estimation range is ± 32 subcarrier spacing when N has a value equal to 1.

Raphaeli explicitly disclosed such a maximum estimation range is ± 32 subcarrier spacing when N has a value equal to 1 (*see col.18 lines 65-67: a specified range*).

Therefore, at the time of the invention, it would be obvious to a person of ordinary skill in the art to implement such an estimation to the *Raphaeli* since the “ ± 32 ” is a quantity of a “64” subcarrier spacing when N has a value equal to 1, thus such an estimation is obvious in a design choice to a person of ordinary skill in the art, the motivation being to provide synchronization to a base station and communications devices in an orthogonal division multiplexing system.

Allowable Subject Matter

6. **Claims 18, and 36-39** are allowed.

7. **Claims 3-6, 10, 11, 20, 22-27 and 30** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Remarks

8. Applicant's arguments filed on July 13, 2004 with respect to **claims 1-40** have been considered but are moot in view of the new grounds of rejection.

Examiner Information

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Anthony T Ton** whose telephone number is **571-272-3076**. The examiner can normally be reached on M-F: 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Ken Vanderpuye** can be reached on **571-272-3078**. The fax phone number for the organization where this application or proceeding is assigned is **703-872-9306**.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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Respectfully submitted,

by : *Ant*
Anthony T. Ton
Patent Examiner
December 18, 2004


**PHIRIN SAM
PRIMARY EXAMINER**